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NOVEMBER, 1915.

ENTOMOLOGICAL NEWS

Vol. XXVI. No. 9.

Juan Gundlach, 1810-1896.

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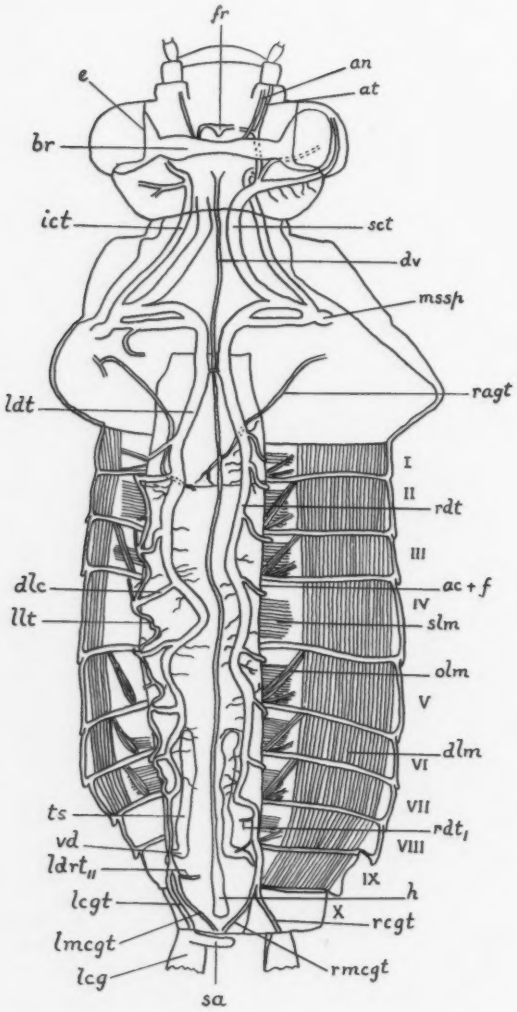

THAUMATONEURA LARVA—CALVERT.

ENTOMOLOGICAL NEWS

AND

PROCEEDINGS OF THE ENTOMOLOGICAL SECTION

ACADEMY OF NATURAL SCIENCES, PHILADELPHIA.

VOL. XXVI. NOVEMBER, 1915. NO. 9.

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Studies on Costa Rican Odonata.

VII. The Waterfall-Dwellers: The Internal Organs of Thaumatoneura larva and the Respiration and Rectal Tracheation of Zygopterous Larvae in general.

By PHILIP P. CALVERT, PH.D., University of Pennsylvania, Philadelphia, Pa.

(Plates XV, XVI, XVII, fig. 1)

The caudal tracheal gills of the larva of *Thaumatoneura*—to give the three most conspicuous, terminal, abdominal parts the name which they have received in other Zygopterous larvae—have been described and figured in No. VI of these Studies.* They are very clearly two-jointed, a condition which has also been described and figured by Needham† for the same parts of the larvae of *Bayadera indica,* of an unknown genus and species from Jamaica, of an unknown genus of the legion Podagrion from India and of a species of *Pseudagrion.* The resemblance between his figure (*l. c.,* pl. v, f. 4) of a lateral

*Ent. News, xxvi, pp. 295-305, pl. xi. July, 1915.
†Ent. News, xxii, pp. 145-154, pls. iv, v; pp. 342-347, pl. xi. 1911.

caudal gill of *Bayadera indica* and ours (Ent. News, xxvi, pl. xi, f. 9) of a median caudal gill of *Thaumatoneura* is very close. This two-jointed condition is of interest since these gills are homologous to the many-jointed middle tail filament and cerci of *Lepisma* and of Ephemerid larvae, while the lateral gills are homologous to the several- to many-jointed cerci of Orthoptera and of larval Perlidae (Heymons 1896, 1904). Heymons termed the median unpaired "gill" the *appendix dorsalis* and the other two the *appendices laterales,* the three collectively *appendices caudales,* applying these terms both to Zygopterous and Anisopterous larvae.

The three caudal appendages of *Thaumatoneura* larvae, although supplied with tracheae whose derivation is homologous with that of the tracheae of the lamellate caudal gills of most Agrionine larvae, present so little surface for respiration that I expected dissection to reveal some rectal tracheal gills comparable with those of the larvae of the Anisoptera. This expectation has been partly fulfilled but, as will be seen from the present paper, the rectal folds in *Thaumatoneura* larva are less numerous and each of the three folds less sub-divided and much less tracheated than is the case in Anisopterous larvae. No observations or experiments bearing directly on the methods of respiration were made on the living larvae of *Thaumatoneura.* We know that in their native waterfalls they are frequently found on rock-faces where they are kept moist, but are not submerged, by the falling water. Their movements, both at large and in our rearing glasses, were never rapid.

Internal Organs of Thaumatoneura Larva.*

Alimentary canal. The *pharynx* is separated from the oesophagus by a distinct constriction lying a little caudad to the level of the brain, but cephalad to the level of the hind margin of the head; the *oesophagus* is defined posteriorly by a constriction in the prothorax separating it from the crop (larva no. 6). The external dorsal surface of the oe-

*Owing to the destruction referred to under the heading "Description of the Larvae," Ent. News, xxvi, p. 300, no larvae specially fixed for histological study have been available, and it has been necessary to rely exclusively on larvae nos. 1-9 (*l. c.*), which were placed in alcohol as soon as their deaths were discovered.

sophagus is marked by two longitudinal streaks of blackish pigment corresponding to the areas of contact with the right and left dorsal tracheal trunks. At mid-length of the oesophagus, at the level of the hind margin of the head, is, on each lateral surface, right and left, a *salivary gland* with a delicate duct running cephalad. The *gizzard* lies in the first abdominal segment; its chitinous armature, in larva no. 4, consists of sixteen longitudinal folds, each of which bears chitinous teeth. In eight of these folds the teeth, near the posterior end, tend to increase from one to two rows, while in the other alternating eight folds the teeth are arranged in a single row throughout. The teeth of the various folds are subequal in size, but in each fold tend to become larger caudad. The formula for the gizzard armature may be written 8 (F 14-17, f 11-14)* The hind end of the *stomach* and the place of attachment of the *Malpighian tubes* lie near the articulation of the fifth and sixth abdominal segments. The *ileum* extends to the seventh segment.

The *rectal epithelium* presents three longitudinal folds, one which is dorsal and a little to the left of the median plane, a second is left latero-ventral, the third is right lateral. Their relative positions may be best seen in a cross-section of the rectum (Pl. XVII, fig. 1). The epithelium is interrupted by three, longitudinal, thinner, pigmented areas, one of which is nearlv midventral (*mvpa*) and lies immediately to the right of the attachment of the left latero-ventral fold, a second (*rlpa*) is immediately dorsal to the right lateral fold, the third (*llpa*) is to the left of the dorsal fold. These three pigmented areas are homologous with the three "non-cellular longitudinal bands" of the rectum of the larva of *Mecistogaster modestus*† and with similarly placed bands in the recta of larvae of *Lestes rectangularis, Argia moesta putrida, A. talamanca, Ischnura verticalis,* etc. Both anterior and posterior to the three longitudinal rectal folds in *Thaumatoneura* larva, the gut epithelium is very much thinner for its entire circumference, equaling, or nearly equaling, in thinness that of the three longitudinal pigmented areas, and containing also much pigment.

Tracheal System. The arrangement of the larger tracheae of the dorsal side of the body is shown in Plate XV. It corresponds, except in a few minor details, with our figure** for the tracheae of *Mecistogaster modestus* larva and those of Cole†† and of Bervoets‡ for a larva of *"Agrion."* The chief difference between the present results and those

*Cf. Higgins, Proc. Acad. Nat. Sci. Phila. 1901, pp. 132, 133.

†Ent. News,.xxii, pp. 452, 453, pl. xvii, fig. 10, 1910. The description of them as "non-cellular" may not be justified when material in better condition is examined.

**Ent. News, xxii, pl. xvii, fig. 8. 1911.

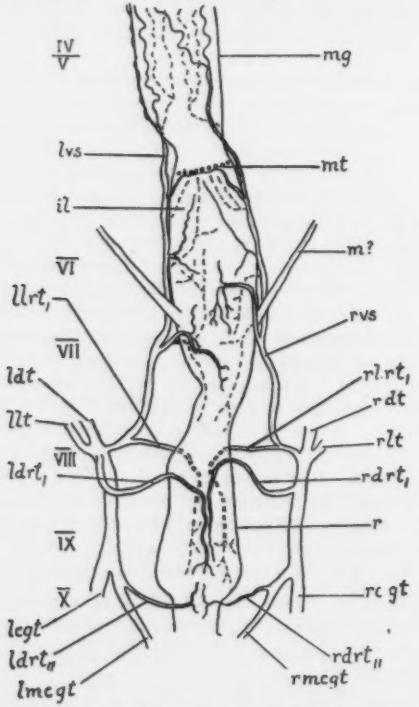
††Journ. Appl. Micros. & Laby. Meth. VI, pp. 2224-5, figs. 7, 8. 1903.

‡Annales Biol. Lacustre, VI, pp. 16, 17, 20, figs. 1-3. 1913.

of the Belgian author is that our serial sections through the posterior part of the abdomen do not show a pair of independent "ventral trunks" which he partially figures and describes.

The *tracheae which supply the rectum* have been studied by a series of transverse serial sections through the hind part of the abdomen of larvae nos. 2 and 7. In spite of the unfavorable condition of the material for a histological investigation, the tracheae were found to be intact even to branches of small diameter (.002 mm.). The rectal epithelium being in a much better state of preservation in larva no. 7, the following brief description and the figures on Plates XVI and XVII have been based chiefly upon that larva.

The two great *dorsal longitudinal tracheae*, right and left, *rdt*, *ldt*, each give off, in the anterior part of the eighth abdominal segment, a



Text-figure 1. The principal tracheae supplying the alimentary canal in the posterior half of the abdomen, *Thaumatoneura* larva, ♂, No. 4. Dorsal view. x 13.3
For explanation of the abbreviations, see page 894.

branch, the *dorsal rectal trachea,* (*rdrt*I, *ldrt*I), which runs mesad and enters the cavity of the dorsal longitudinal rectal fold. Within this fold this trachea divides and subdivides, but no anastomosis between any of the smallest subdivisions of the right dorsal rectal trachea with subdivisions of the left dorsal rectal trachea have been found, in spite of special search for them.

A short distance anterior to the origin of each dorsal rectal trachea a *lateral rectal trachea* (*rlrt*I, *llrt*I), arises, either indirectly from the dorsal longitudinal trachea (*cf.* text-figure 1 and right side of Plate XVI), or from the lateral longitudinal trachea (*cf.* left side of the same Plate), which extends mesad and caudad and enters the lateral longitudinal rectal fold of the same side of the viscus, within which it subdivides. A smaller, posterior, tracheal supply (*rlrt*II, *llrt*II) is also received by these lateral rectal folds from branches either from the lateral longitudinal trachea or from the median caudal gill trachea, as may be seen by comparing the right and left sides respectively of Plate XVI. No anastomoses of tracheoles from the anterior supply of the lateral rectal folds with those of the posterior supply have been detected.

A small posterior tracheal supply for the dorsal rectal fold is received from the right and left median caudal gill tracheae (tracheae *rdrt*II, *lrdt*II of Plate XVI). Here again no anastomoses, either transverse or longitudinal, have been found.

The only anastomosing tracheae which have been discovered are the posterior terminations of the right and left lateral longitudinal tracheae which, assuming a ventral position, meet on the mid-ventral line ventrad of the alimentary canal; in this anastomosis (*anas*) take part also a branch from the right and a branch from the left lateral caudal gill trachea. These four anastomosing tracheae, since they lie ventrad to the rectum, have been represented by lines of alternating dots and dashes in Plate XVI. A similar anastomosis in *Mecistogaster modestus* has been figured* in No. III of these studies and has been found by the writer in transparent living larvae of *Hetaerina americana, Argia moesta putrida* and *Ischnura verticalis;* it has not been figured for Anisopterous larvae and may prove to be a characteristic of those of the Zygoptera.

A comparison of the works of authors who have described the tracheae of Odonate larvae has yielded the table on page 390.

The *terminal tracheoles,* of the tracheae which run into the longitudinal rectal folds, enter the epithelium, although whether they merely pass between the epithelial cells or actually penetrate the latter, the condition of the material does not enable one to decide. The diameter of some of these infra-epithelial tracheoles, near their point of final

*Ent. News, xxii, pl. xvii, fig. 7. 1911.

HOMOLOGIES OF THE PRINCIPAL LONGITUDINAL TRACHEAE OF ODONATE LARVAE AS DESCRIBED AND FIGURED BY DIFFERENT AUTHORS.

Author, date, reference and species		Names of Tracheae adopted in this paper.		
		DORSAL	VISCERAL	LATERAL
Carus, 1827, Taf. II, fig. 2 and p. 15 [*Lestes sponsa*]		*d* [on left side of figure only] zwei zu beiden Seiten des Leibes verlaufende Trachеenstämme.....den grossen Tracheenstämmen.		
Suckow, 1828. Taf. I, figs. 7, 9. *Aeshna grandis*		*o*, *o* zwei grosse Tracheenstämme	*q* ein geradelaufender	*p* ein dünnerer schlangenförmiger Tracheenstamm
Dufour, 1852. Pl. 5 and pp. 77-79	Fig. 28 *Aeshna grandis*	*hh*, canaux aérifères supérieures	*ii* canaux aérifères intermédiaires	Canaux aérifères inférieures (pp. 78, 79)
	Fig. 32 *Calopterix virgo*	*i* canal aérifère supérieure		
	Fig. 33 *Agrion puella*	*hh*, canaux aérifères supérieures		Canaux aérifères inférieures (pp. 78, 79)
Oustalet, 1869. Pl. 22, fig. 1. *Aeschna maculatissima*		*A*, *A* troncs supérieurs ou *dorsaux*	*BB*, troncs moyens ou *visceraux*	*CC*, troncs inférieurs ou *ventraux*
Palmén, 1877. Taf. I, fig 14 and p. 37. *Agrion.*		*trl* die beiden dorsal	Der dritte Längsstamm	*trl 1* secundären Längsstamm, den ventralen
Roster, 1885. Tav. III and pp. 260-261 *Aeschna cyanea.*		paio esterno* e dorsale; canali centrali superiori	paio viscerale; canali viscerali; tronchi viscerali	paio ventrale o laterale; tronchi ventrali o esterni*
Scott, 1905. Figs. 1, 2 and pp. 345-349 *Plathemis lydia.*		*DORS* The dorsals	*VENT* The ventrals	*LAT* Lateral system
Calvert, 1911*a*. Pl. III, fig. 22. *Cora.*		*ldt*, *rdt*, dorsal tracheae	*lpgt*, (left) posterior gastric trachea	*llt*, *rlt*, lateral tracheae
Calvert, 1911*b*. Pl. XVII, fig. 8. *Mecistogaster modestus.*		*ldt*, *rdt*, dorsal tracheae		*llt*,(left)lateral trachea
Bervoets, 1913. Figs. 1, 2. *Agrion.*		gros troncs lateraux	troncs ventraux	troncs lateraux ventraux†

* Roster has applied the terms *esterno*, *esterni*, to both of these tracheae.

† Bervoets adds (p. 18), "Cette pair de troncs... pourrait être appelée viscérale. Chez les Anisoptères, ces troncs se croisent sur le ventricule chylifique." I think, however, that he is in error in this homologization.

disappearance in the serial sections, is but .002 mm.* The manner of termination has not been ascertained.

The great majority of the tracheae in the abdomen, of all sizes from the great longitudinal trunks to the infra-epithelial tracheoles, possess an abundance of *blackish pigment* in their own epithelial layers. This pigment is evident both in entire preparations and dissections mounted in balsam and also in the sections from blocks of material embedded in paraffin, and greatly increases the ease with which these vessels may be traced. It presents the same appearance as that of the pigment in the "three, longitudinal, thinner pigmented areas" of the rectum, described above, and in other parts of the body, such as the epithelial layer of the pharynx, the connective tissue envelopes of the frontal ganglion, of the brain and of at least some of the ganglia of the ventral nerve cord.

This pigment is perhaps the same as that for which Purser (1915, p. 67) has proposed the name "spadicin" and which he suggests may have a respiratory function. His statements that spadicin "only appears in the respiratory organs of true aquatic insects" (p. 68) and "is not situated in the tracheal epithelium but in the hypodermis" [of Agrionid larval tracheal gills and in those of *Aeschna?*] (p. 69) are not entirely in accord with conditions here described for *Thaumatoneura.*

Transverse sections of the hind end of the abdomen and of *median and lateral caudal gills* show that the tracheae, supplying the latter organs do not enter them as single, relatively large trunks, but that each trachea divides and redivides into a number (four or more) of subequal tracheae which collectively pass into the base of the gill. Neither the sections of the gills nor entire mounts of these organs indicate any rich development of tracheae within them. The thickness of the chitinous cuticle of the proximal joint, as measured in cross-sections of the median caudal gill and of one lateral caudal gill of larva no. 2, varies from .012 to .016 mm., and .004 to .016 mm. respectively. There is much less blackish pigment in the epithelial layer of the tracheae of these gills than in that of the tracheae of the abdomen. Pigment is present in the epithelium of the gills themselves, but is not uniformly distributed therein.

The same sections of the median caudal gill show the presence of two median *blood spaces,* one dorso-central, the other ventro-central, situated respectively ventrad and dorsad to other blood spaces which largely occupy the mid-dorsal and mid-ventral longitudinal carinae of the proximal joint. These two central blood spaces have thin but distinct walls, contain plasma and corpuscles in their lumens and lie in the midst of a reticulated or spongy tissue; their transverse diameter, near

E. g., in the dorsal fold, slide 5, row 3, section 20, of our series of larva no. 7.

the base of the gill, is about one-fifth of that of the gill itself. More posteriorly they are smaller, both relatively and absolutely, and they are not shut off from communication with other spaces. In the caudal end of the proximal joint, the two central blood spaces become confluent as one central space, whose vertical diameter is almost as great as that of the gill itself exclusive of the mid-dorsal and mid-ventral carinae. This central blood-space is continued caudad into the distal joint, occupying most of the interior thereof. The chitinous cuticle of this joint is, in these sections, .012 mm. thick.

The lateral caudal gill has a dorsal and a ventral longitudinal blood-space near the two longitudinal carinae of the mesal surface, respectively. A third appears to run along its lateral or external face.

A number of resemblances between the internal structure of the caudal gills of *Thaumatoneura* and those of *Euphaea variegata* described by Ris (1912, pp. 171-3) are evident.

Nerve ganglia. The positions of the ganglia other than the brain are as follows. The *frontal* ganglion, triangular in shape, with its apex directed caudad (Pl. XV, *fr*), lies on the dorsal surface of the pharynx a short distance (about .15 mm. in larva no. 2) anterior to the brain; it is connected on each side, right and left, with the cerebro-suboesophageal connective. *Suboesophageal* ventral to the pharynx, at the level of mid-length of the eyes. *Prothoracic* in the hind end of the prothorax, *mesothoracic* in the front part of the mesothorax, *metathoracic* in the hind part of the mesothorax; the thoracic ganglia are separated from each other by intervals shorter than the length of each. *First abdominal* in the hind part of the metathorax, *second* in the middle of abdominal segment 2, *third to seventh* in the front ends of segments 4 to 8 respectively. These positions of the thoracic ganglia are obtained from larvae nos. 2, 4, and 6, of the abdominal from larvae nos. 4 and 6.

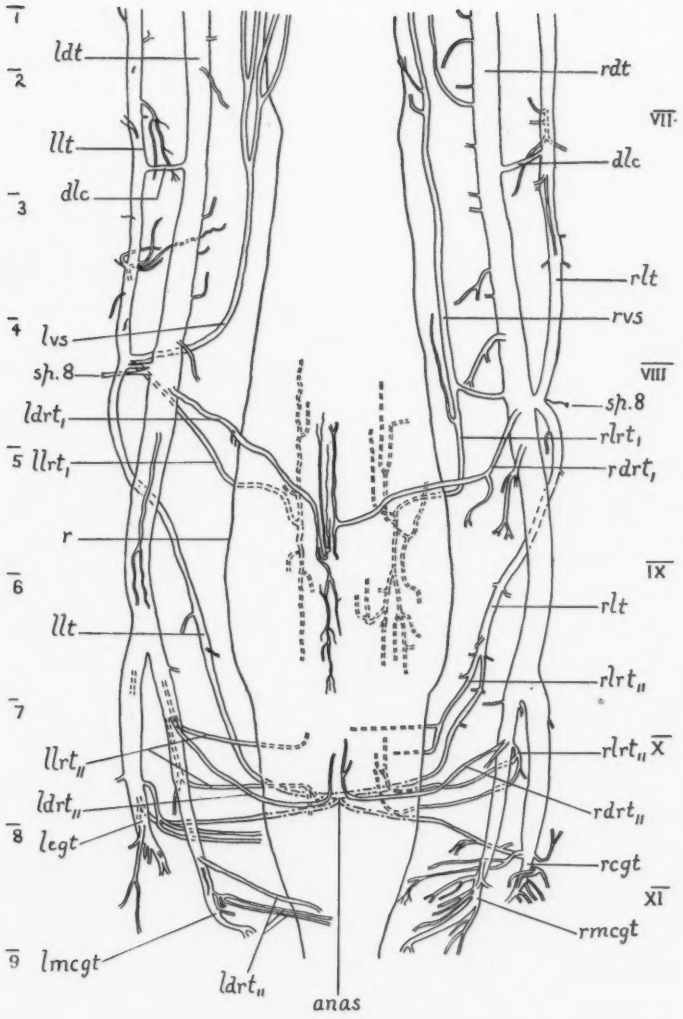
(To be continued)

Explanation of Plates XV, XVI, XVII.

Plate XV. Dorsal tracheae and some other organs of *Thaumatoneura* larva ♂, no. 4. The dorsal wall of the head has been removed except over the eyes, that of the thorax and of the abdomen has been opened longitudinally to the left of the mid-dorsal line and turned to the right. x 6.1.

Plate XVI. Diagram of the tracheal supply of the alimentary canal in the hind part of the abdomen of *Thaumatoneura* larva, dorsal view. x 37.6.

This diagram has been reconstructed on a horizontal plane from about 850 serial transverse sections from larva no. 7, mounted on 9 slides now in the writer's collection at the University of Pennsylvania. To avoid confusing tracheae which lie approximately in the same vertical planes, the tracheae are represented farther to right and to left



THAUMATONEURA LARVA—CALVERT.

2.

1. THAUMATONEURA LARVA—CALVERT.

2. VANESSA ANTIOPA ABERRATION—KEIL.

from the gut and from each other than is actually the case. The true relative positions may be learned by comparing this figure with figure 1 of Plate XVII. The origins of the various branch-tracheae and their subdivisions to the most minute branches have been indicated as exactly as possible from the sections. The tracheae which do not lie upon the gut wall or do not enter the rectal folds have not been shown farther than short distances from their origins, even though they may lie dorsad or ventrad to the gut; this for the sake of avoiding confusion. The only exceptions to this statement are in the cases of the tracheae which take part in the anastomosis (*anas*) mid-ventral to the rectum in abdominal segment X; these tracheae are indicated by lines of dashes alternating with dots, thus — . — . — . — . Of the tracheae which supply the rectal walls, those which run on the dorsal surface or enter the dorsal longitudinal fold are shown in solid lines; those which run on the ventral surface or enter the lateral rectal folds are shown in broken lines, thus — — —, as soon as they cross the outlines of the gut.

In one respect this diagram departs from the conditions shown in the sections of larva no. 7. In those sections the right lateral trachea (*rlt*) becomes much smaller in abdominal segment VII than its fellow of the left side and disappears as several minute tracheae before connecting again with the dorsal trachea. This, after comparison with other larvae, appears to be an anomaly, so that the right lateral trachea is here represented as being similar to, but not identical with, the left lateral. The branch tracheae *rvs, rlrt*1, which on the right side of the diagram come from the dorsal longitudinal trachea, are exactly as in the sections, although the corresponding tracheae *lvs, llrt*1, on the left side come from the lateral longitudinal trachea. This difference in the two sides of larva no. 7 may be due to the atrophy of the right lateral longitudinal trachea just mentioned. Compare, however, the same tracheae in text-figure 1, page 388. The right lateral trachea *is present* in the sections from its point of separation from the right dorsal in the anterior part of segment VIII as represented in the diagram.

The figures 1-9 on the left side of this plate indicate the levels of the first section of each slide, 1-9 respectively.

Plate XVII, fig. 1. Part of photograph of section 18, row 1, slide 6, of the author's series of sections of *Thaumatoneura* larva no. 7 ♀, made with Leitz oc. 4, obj. 3, by Mr. H. A. Walters. The section is viewed from its anterior surface. x 72.5.

Abbreviations Used in Plates XV-XVII.

ac + *f*, outline of alimentary canal and superimposed fat masses; in Plate XV it corresponds also very nearly to the lateral edges of the sternites.

an, antennal nerve.

anas, anastomosis of tracheae in abdominal segment X.

at, antennal trachea.

br, brain.
cf, connective tissue and fat.
dlc, transverse tracheae connecting the dorsal and lateral longitudinal tracheae.
dlm, dorsal longitudinal muscles.
drf, dorsal rectal fold.
dv, dorsal vessel.
e, eye, mesal outline.
fr, frontal ganglion.
h, heart.
ict, inferior cephalic trachea (to ventral muscles of head).
il, ileum.
lcg, left caudal gill.
lcgt, left caudal gill trachea.
*ldrt*I, anterior or chief left dorsal rectal trachea.
*ldrt*II, posterior or secondary left dorsal rectal trachea.
ldt, left dorsal trachea.
llpa, left lateral pigmented area of rectum.
llrf, left lateral rectal fold.
*llrt*I, anterior or chief left lateral rectal trachea.
*llrt*II, posterior or secondary left lateral rectal tracheae.
llt, left lateral trachea.
lmcgt, left median caudal gill trachea.
lvs, left visceral trachea.
m, muscle.
mg, midgut (stomach).
mssp, mesostigma (mesothoracic spiracle).
mt, Malpighian tubes.
mvpa, midventral pigmented area of rectum.
n, nerves (in Pl. XVII, fig. 1, running caudad from last ganglion).
olm, oblique lateral muscle.
r, rectum.
ragt, right anterior gastric trachea.
rcgt, right caudal gill trachea.
*rdrt*I, anterior or chief right dorsal rectal trachea.
*rdrt*II, posterior or secondary right dorsal rectal trachea.
rdt, right dorsal trachea.
rlpa, right lateral pigmented area of rectum.
rlrf, right lateral rectal fold.
*rlrt*I, anterior or chief right lateral rectal trachea.
*rlrt*II, posterior or secondary right lateral rectal tracheae.
rlt, right lateral trachea.
rmcgt, right median caudal gill trachea.
rvs, right visceral trachea.
sa, superior appendages of imago ("cercoids").
sct, superior cephalic trachea (to antenna, brain, optic lobe and eye).

slm, straight lateral muscle.
sp.8, site of future spiracle of 8th abdominal segment.
ts, testis.
vd, vas deferens.
vlm, ventral longitudinal muscles.

The Roman numerals I-XI indicate abdominal segments 1-11 respectively.

The names of the abdominal muscles are, as nearly as possible, those employed by Matsula in Pflüger's Archiv f. Physiologie, cxxxviii, pp. 390-392, text fig. 1, 2. 1911.

An Aberration of Vanessa antiopa (Lep.).

By Ernst Keil, Pasadena, California.

(Plate XVII, fig. 2)

The specimen figured on the accompanying plate was taken on July 7th, 1914, at Granville, Ohio, on the Denison University campus by the writer. It was captured in the morning sitting on the trunk of a walnut tree which was one of a large number of trees that had been sugared the night before. The specimen had been enjoying the remains of the night's banquet. There were other specimens of *Vanessa antiopa* captured at the same place and time which were all normal. The specimen in question expands 70 mm., three wings are normal and have the ornamentation of a male specimen. The left hind wing, however, has the blue dots missing altogether, the yellow edge is about 2 mm. broader than the edges of the other wings and is of a whitish yellow. The rest of the wing is dull black instead of reddish brown, and the vein structure is exactly the same as that of the other wings.

Do Insects Migrate Like Birds?

Under this title, Howard J. Shannon discusses in *Harper's Monthly Magazine* for September, 1915, the observed migrations, both northward and southward, in the United States, of the monarch butterfly and of dragonflies like *Anax junius*. He briefly sums up the European data also, on swarms of Odonata. He considers that insects in migration follow much the same routes as do the birds, and concludes that "accumulating evidences show that the principles and laws governing the better-known bird migrations have a remarkable parallel in the annual movements of certain members of the insect world."

A New Trichogrammatid from Trinidad (Hym.).

By A. A. GIRAULT, Washington, D. C.

Uscana pallidipes new species.

Female.—Length, 0.55 mm. Black, the legs, head and thorax pale golden yellow, except for a large, triangular black area from cephalic margin of scutum to about middle, divided along the meson by yellow and not extending to lateral margins. Fore wings distinctly infuscated out to the end of the stigmal vein.

Marginal fringes of caudal wing distinctly longer than the greatest width of the blade, the latter bearing a single, complete line of discal ciliation a little cephalad of the middle. Fore wings with about 4-7 setae in the oblique line of discal cilia from the stigmal vein, with about seven complete, regular lines of discal cilia from apex to a line drawn across apex of the venation (a few short lines between the others distad), the marginal cilia longer than usual (about a little over one-fourth the greatest wing-width, uniform and longest around the rather broadly flattened apex, the blade widest just proximad of apex), the marginal ciliation somewhat shorter than that of the hind wings. Stigmal vein not quite half the length of the marginal, the latter distinctly over half the length of the submarginal and with a number of short setae from its surface. A patch of 6-12 minute setae (the cephalic 2-3 larger) near caudal margin about opposite middle of the marginal vein.

Pedicel stout, somewhat longer than wide, not half the length of the club. Club with rather long, scattered setae, acuminate, without a terminal spine. Scape slender, not long. Tarsal joints not long. Abdomen short, conic-ovate, the ovipositor inserted at about the middle.

Male.—The same, except for the different shape of the abdomen.

Described from five males, one female marked "Horiola sp. Pt. Spain. P. Lachmere-Guppy. Letter November 27, 1911." The fourth trichogrammatid from *Horiola* eggs.

Habitat: Port of Spain, Trinidad, West Indies.

Type: Cat. No. 19,131, U. S. National Museum, Washington, one female on a slide with a male allotype and paratype. A second slide with three males in same collection.

Differs markedly from *semi-fumipennis* (types compared) in having the legs all pale, the wings distinctly narrower and much less ciliated discally, the marginal cilia distinctly much longer, also the marginal vein, the caudal wings bear only one line of discal cilia (three in the genotype), the stigmal vein is not half the length of the marginal (more than half in the genotype), the stigmal vein is not darkened as in the other and the general coloration is somewhat different (the yellow coloring of the thorax duller in the genotype).

This species has the general appearance of *Tumidiclava pulchrinotum* Girault when viewed with a hand lens, but the club is not swollen and the stigma vein is normal.

Dermaptera and Orthoptera Found in the Vicinity of Miami, Florida, in March, 1915—(Part 1).

By Morgan Hebard, Philadelphia, Pa.

(Plate XVIII.)

From the 3d to the 16th of March, 1915, the author was in Miami, Florida, during which time collecting was only undertaken part of each day, but special efforts were made to secure material of the least known forms. In this way, while a mere representation of the well known species was taken, certain particular areas were very thoroughly and repeatedly investigated and several most interesting facts were thereby ascertained. A series of 654 specimens was taken, which material is now in the Hebard Collection.[1] This series represents 72 forms of which 2 are new and 5 previously not known from southern Florida, 2 of these latter constituting first records for the United States.

The region under consideration is divided into a number of distinctive areas, of which the "hammock" and the red mangrove swamps received the most thorough investigation. The facts concerning the various areas may be set forth as follows:

"Hammock."[2]

The heavy jungle areas, called in the vernacular "hammocks," and small areas of which, scattered through the pine woods of this region, are generally known as "banana-holes,"[3] contain a number of most interesting species of Orthoptera, particularly of the tropical forms. Individuals of these are, however, almost without exception very scarce and certain spe-

[1] In addition, 22 other specimens from this region are here recorded. Mr. Rehn and the present author have already recorded 4481 specimens of Orthoptera from central and southern Florida. (1905. Proc. Acad. Nat. Sci., Phila., 1905, pp. 29-55; 1912. Ibid., 1912, pp. 235-276; 1914. Ibid., 1914, pp. 373-412, and 1914. Jour. N. Y. Ent. Soc., XXII, pp. 96-117. The great majority of this material is in the Hebard Collection and that of the Academy of Natural Sciences of Philadelphia.

[2] One of the most extensive "hammocks" in southern Florida was particularly investigated; this is Brickell's Hammock, which occupies several square miles of territory between Miami and Cocoanut Grove and is readily accessible from the former place.

[3] See J. W. Harshberger. Trans. Wagner Free Inst. Sci., Phila., VII, p. 101. (1914.)

cies can only be secured after repeated and long-continued investigations with trowel and beating net. The interesting species of the Tettigoniidae found here were, at this time of year, without exception in the earlier stages of immaturity. Under the bark of certain lofty trees growing in this hammock, particularly *Exothea paniculata* and *Coccolobis laurifolia*,[4] a number of very interesting forms were found hidden during the day. These could best be collected by tearing loose patches of bark off with a trowel and holding a beating net beneath at the same time. Six molasses jars were placed in this hammock, but little material was secured in this manner. During this visit unprecedentedly cold weather was encountered which made night work either unsatisfactory or wholly out of the question. In warm weather this method would certainly prove one of the readiest means to secure a number of the desirable species.

Mangrove Swamps.[5]

These areas were found to be by no means as barren of Orthoptera as we had supposed. Two peculiarly Antillean species of Gryllidae were found in and along their borders and, in addition, an undescribed species of this family was found in the deep shade among the mangrove roots. A very few specimens of other species of Orthoptera were encountered in this environment, while everywhere above in the foliage of the mangroves a Gryllid, ubiquitous in green foliage wherever found in southern Florida, was heard. In summarizing we would state that Orthoptera are generally very scarce in these swamps, but certain of the species are not found elsewhere and occasionally a species is found there locally abundant. The deep shade, labyrinth of roots and presence in unpleasant numbers of mosquitoes, even as early as March, make work in these areas unusually difficult.

[4] For the botanical determinations in the present paper we wish to express our hearty thanks to Mr. Stewardson Brown of the Academy of Natural Sciences of Philadelphia.

[5] We here refer only to the red mangrove, *Rhizophora mangle*. In areas of black mangrove, *Avicennia nitida*, or open marshy flats, covered with the shoots of this tree, none of the species of Orthoptera here recorded have been encountered.

Pine Woods.

A great portion of the region is covered by pine woods, *Pinus caribaea*. This area is very open, the ground is extremely rough, being composed in most places of oölitic limestone and is carpeted with a large variety of low vegetation in which the wire grass and saw palmetto are everywhere found. Considerably larger series of Orthoptera could be taken in these woods during March than elsewhere, but as the majority of the species were already well known to us, but little time was given on this trip to this area. A number of interesting captures were, however, made.

Salt Marshes and Everglades.

These two areas were most unproductive, almost all of the abundant Tettigoniidae found in the Fall not being yet apparent, even as tiny immature individuals.

Sea Beaches.

But one species of Acridid is found on the sand beaches, but back of these in the halophytic vegetation, *Ipomaea pes-caprae, Canavalia lineata* and other plants, a number of species were encountered. Individuals of several of these were of interest in being of decidedly larger average size than material from inland situations.

DERMAPTERA.

Anisolabis annulipes (Lucas). Brickell's Hammock, Miami, III, 4, 1915, (H.), 1 ♀.

Labidura bidens (Olivier). A crushed individual of this species was seen on the sidewalk at Miami.

Prolabia unidentata (Beauvois). Southside, Miami, III, 6, 1915, (H.), 4 ♀.

This species was found abundant under the dried bark of all of the logs of *Pinus caribaea* examined.

ORTHOPTERA.

Blattidae.

Ischnoptera deropeltiformis (Brunner). Brickell's Hammock, Miami, III, 4 to 15, 1915, (H.; trapped in molasses jar), 2 juv. ♂.

Blattella germanica (Linnaeus). Common in habitations at Miami.

Ceratinoptera diaphana (Fabricius). Brickell's Hammock, Miami, III, 4, 1915, (H.; under loose bark on trunk of tree, *Exothea paniculata,* in dense jungle), 1 juv. ♀.

Ceratinoptera lutea Saussure and Zehntner. Brickell's Hammock, Miami, III, 3, 1915, (H.; on ground under luxuriant undergrowth in opening in forest), 1 ♂. Virginia Key, III, 11, 1915, (H.; in dark water-soaked leaves in heavy red mangrove swamp), 1 juv. ♂.

Eurycotis floridana (Walker). Brickell's Hammock, Miami, III, 4 to 15, 1915, (H.; trapped in molasses jars), 1 ♂, 2 ♀, 3 juv. ♂.

This unpleasant roach was found particularly numerous in tree cavities and under bark along the edge of the hammock. It was the only species found attracted to the molasses jars in numbers.[6]

Periplaneta australasiae (Fabricius). Southside, Miami, III, 16, 1915, (H.; a few juv. under bark of dead logs of *Pinus caribaea* in company with numbers of *Prolabia unidentata*), juv. ♀.

This is the only household pest which, in this region, appears frequently numerous outside of dwellings as well.

Pycnoscelus surinamensis (Linnaeus). Brickell's Hammock, Miami, III, 4, 1915, (H.), 1 juv. ♀.

In this region, the present species is ubiquitous on the ground under litter of any sort. At Musa Isle, it was found burrowing in the sand when search was being made for *Scapteriscus abbreviatus.*

Plectoptera poeyi Saussure.

We have a male before us in the Hebard Collection from Cocoanut Grove, Florida, taken in 1887 by E. A. Schwarz. The species has not been previously recorded from the United States except from Key West, Florida.

MANTIDAE.

Stagmomantis carolina (Johannson). Brickell's Hammock, Miami, III, 3, 1915, (H.; juv. occasional in heavy vegetation along edges of openings in hammock), 2 juv.

Gonatista grisea (Fabricius). Brickell's Hammock, Miami, III, 4, 1915, (H.; juv. rare on trunks of trees), 1 juv. Virginia Key, III, 11, 1915, (H.; on roots of mangrove in dense mangrove swamp), 1 juv.

[6] A number of specimens secured were not retained.

The latter specimen here recorded was much darker in general coloration than is normal for the young of this species.

Oligonyx scudderi Saussure. Southside, Miami, III, 16, 1915, (H.; undergrowth in pine woods), 1 juv. ♀.

The species has never before been recorded from a definite locality in this state.

Thesprotia graminis (Scudder). South of Brickell's Hammock, Miami, III, 3, 1915, (H.; undergrowth of pine woods), 1 juv. ♀. Southside, Miami, III, 6, 1915, (H.; in gallberry bushes in pine woods), 3 ♀.

PHASMIDAE.

Manomera tenuescens (Scudder). Southside, Miami, III, 6, 1915, (H.; in low bushes in undergrowth of pine woods), 1 juv. ♂, 1 juv. ♀.

Anisomorpha buprestoides (Stoll). Southside, Miami, III, 6, 1915, (H.; young in early stages occasional in undergrowth of pine woods), 1 juv. ♀.

ACRIDIDAE.

Neotettix femoratus (Scudder). Southside, Miami, III, 6, 1915, (H.; occasional in spots of scant vegetation in pine woods), 4 ♂, 4 ♀, 1 juv. ♀. South of Brickell's Hammock, Miami, III, 3, 1915, (H.; occasional on edge of salt marsh), 4 ♂, 2 ♀.

Of this series, three males alone are typical of *femoratus;* the others show to varying degrees the condition found in *Neotettix bolteri,* which is most strongly marked in one female. One male and four females have the pronotum caudate.

Tettigidea spicata Morse. Miami, III, 3 and 10, 1915, (H.; in short grass), 1 ♂, 2 ♀. Brickell's Hammock, Miami, III, 4, 15 and 16, 1915, (H.; in openings in hammock, in and on edge of red mangrove swamp), 4 ♂, 5 ♀. Cape Florida, Key Biscayne, III, 12, 1915, (H.; in red mangrove swamp), 1 ♀.

The dark bare soil along the edges of the red mangrove swamps was the situation in which the greatest number of specimens of this rather scarce species were found.

Tettigidea lateralis lateralis (Say). Brickell's Hammock, Miami, III, 15, 1915, (H.; dark soil on edge of red mangrove swamp), 1 ♂.

Radinotatum brevipenne peninsulare Rehn and Hebard. Southside, Miami, III, 6 and 16, 1915, (H.; undergrowth of pine woods), 7 ♂, 8 ♀, 1 juv. ♀. South of Brickell's Hammock, Miami, III, 3, 1915, (H.; undergrowth of pine woods), 2 ♂, 1 juv. ♂, 1 juv. ♀.

This species was everywhere found in the undergrowth of the pine woods, the majority of specimens being adult.

Macneillia obscura Scudder. Southside, Miami, III, 6 and 16, 1915, (H.; undergrowth of pine woods), 5 ♂, 7 ♀, 2 juv. ♂, 8 juv. ♀.

This series exhibits a wonderful diversity of the striking and beautiful color pattern and colorations found in the species, no two specimens being exactly alike but the females showing the greatest differences. Those with the very pale medio-dorsal stripe and those with green lateral markings are the most striking of these. The insect was found widely distributed through the undergrowth of the pine woods but always in few numbers.

Amblytropidia occidentalis (Saussure). Southside, Miami, III, 6, 1915, (H.), 3 ♂. South of Brickell's Hammock, Miami, III, 3, 1915, (H.), 2 ♂, 1 juv. ♂.

The species was not abundant in the undergrowth of the pine woods.

Orphulella pelinda Burmeister. North border of Brickell's Hammock, Miami, III, 4, 1915, (H.; undergrowth in live oak groves), 1 juv. ♀. Southside, Miami, III, 16, 1915, (H.; undergrowth of pine woods), 1 ♂.

But one adult of this species, which later appears in large numbers, was found.

Arphia granulata Saussure. Southside, Miami, III, 6 and 16, 1915, (H.), 7 ♂, 5 ♀. South of Brickell's Hammock, Miami, III, 3, 1915, (H.), 2 ♂, 1 juv. ♀.

This species was widely distributed through the undergrowth of the pine woods but always few in numbers. The males show some diversity in coloration, the females considerably more.

Chortophaga australior Rehn and Hebard. Miami Beach, III, 7 and 12, 1915, (H.; moderately numerous locally in halophytic vegetation along beach), 5 ♂, 6 ♀, 1 juv. ♂. North

border of Brickell's Hammock, Miami, III, 4, 1915, (H.; adults occasional, young abundant in undergrowth of live oak groves), 1 ♂. Cape Florida, Key Biscayne, III, 12, 1915, (H.), 1 very small juv. ♀.

The specimens from Miami Beach are very large for this species, a condition even more pronounced in *Aptenopedes sphenarioides clara.*

Pardalophora phoenicoptera (Burmeister). Southside, Miami, III, 6, 1915. (H.; undergrowth of pine woods), 1 juv. ♀.

A decided lamellation of the dorsal and ventral margins of the caudal femora is noticeable in this specimen. The coloration of the caudal limbs is very brilliant. The species was previously known from peninsular Florida only from Lakeland.

Scirtetica marmorata picta (Scudder). Miami Beach, III, 7 and 12, 1915, (H.; very scarce and local in sand areas back of beach proper), 3 ♂, 1 ♀, 2 juv. ♀. Southside, Miami, III, 6, 1915, (H.; one colony found in sandy area in pine woods), 3 ♂, 1 ♀. Musa Isle, III, 10, 1915, (H.; sandy soil in grapefruit grove), 1 juv. ♀.

The females from Miami Beach are unusually pinkish in general coloration with darker markings greatly reduced.

Psinidia fenestralis (Serville). Miami Beach, III, 7 and 12, 1915, (H.; scarce and local in sandy areas back of beach proper), 4 ♂, 3 ♀, 1 juv. ♀. Southside, Miami, III, 6, 1915, (H.; adults and young scarce in sandy spot in pine woods), 1 ♀.

Trimerotropis acta[7] new species. (Pl. XVIII, figs. 1A-1E).

1905. *Trimerotropis maritima* Caudell (not *Locusta maritima* Harris, 1841), Ent. News, XVI, p. 218. [Palm Beach, Florida.]

1914. *Trimerotropis citrina* Davis (in part not of Scudder, 1876), Jour. N. Y. Ent. Soc., XXII, p. 195. [Ocean Beach (Miami Beach), Florida.]

The present species is closely related to *T. maritima* and *T. citrina.* When compared with the former it is found to average smaller. The lateral carinae of the frontal costa are normally not as distinct below the median ocellus. The lateral lobes of the pronotum are more compressed cephalad of the principal sulcus, with the disk at this point more distinctly narrowed as a result, and with caudal margin of disk less produced, the angle being normally rectangulate. The tegmina are proportionately similar but not as long relatively when compared

[7] From ἀκτὴ = the strand.

with the body length; when in repose the anal fields of the tegmina are similarly deplanate with coloration normally paler and less maculate than the discoidal and marginal fields. When compared with *citrina* the present insect is found to be more robust. The frontal costa is slightly wider and also shows the same feature of the lateral carinae as given above. The lateral lobes of the pronotum are much more compressed cephalad of the principal sulcus, with disk at this point much more distinctly narrowed as a result, but with caudal margin of disk similar (in *citrina* the caudal angle of the disk is, however, more frequently slightly less than rectangulate). The tegmina in *citrina* differ in being proportionately wider and also relatively more elongate when compared with the body length, and in having the anal fields when in repose not as strikingly deplanate with coloration the same as the remaining portions. The caudal femora are similar in the two species.

The coloration and markings of this species are normally distinctive. The caudal tibiae in all of the material before us are scarlet (60% red, 40% orange), in *citrina* these portions are grenadine red (40% red, 60% orange). As in *maritima,* this species has the internal faces of the caudal femora pale yellowish with two dark bands, with genicular areas not at all or but little suffused; in *citrina* the coloration of these portions is similar but with the genicular areas normally black.

Type: ♀ ; Miami Beach, Florida. March 7, 1915. (Hebard). [Hebard Collection Type No. 405.]

Description of Type. Size medium, form moderately robust for the genus. Head similar to that of *maritima,*[8] with face even smoother and less pitted than in that species. Pronotum rather short, prozona distinctly compressed this greatest at the cephalic dorsal suture, metazona deplanate. Median carina not strongly but distinctly bicristate on the prozona, the cephalic slightly longer than the caudal crest but of equal height; of almost equal height cephalad but very gradually less prominent caudad on the metazona. Lateral carinae well developed on metazona but continued well defined by the color pattern only on metazona. Tegmina moderately elongate, proportionately narrow. Wings of much the same proportions as in *maritima;* wing band narrow but solid, with greatest width in the radiate field, 4. mm. Caudal femora as in *citrina.* Coloration distinctive.

Allotype: ♂ ; same data as type but taken March 12, 1915.

Description of Allotype. Very similar to type but smaller, agreeing in all other characters given except width of wing band which is in greatest width in the radiate field, 4.7 mm.

In addition to the type and allotype, the series of 34 males

[8] A difference in the frontal costa, discussed above, is well indicated in this specimen; this difference, though slight, is indicated in the majority of specimens of the present species before us.

and 19 females from the same locality may be considered paratypes.

Measurements (in millimeters)

	♂		♀		♂ ♀ Capron, Fla.	
	ALLOTYPE	PARATYPES[9]	TYPE	PARATYPES		
Length of body	21.8	21.7-24	27.4	27.3-31.2	20.3	28.9
Length of pronotum	4.4	4.4-5	5.5	5.2-6	3.9	5.4
Caudal width of pronotum	3.7	3.6-4	4.8	4.4-5.1	3.3	4.6
Length of tegmen	24.3	22.6-24.4	28.	27.-30.9	22.8	29.6
Greatest width of tegmen	3.8	3.6-4.3	4.7	4.6-5.2	3.5	5.
Length of wing	21.5	20.7-25	24.8	24.8-28.9	—	—
Greatest width of wing	11.8	11.3-13.9	13.4	13.4-15	—	—
Length of caudal femur	12.6	12.6-13.7	14.8	15.-16.4	12.	15.2

Coloration. Ochraceous buff to apricot buff in general coloration. The anal fields of the tegmina are usually immaculate, occasionally weakly washed with white, rarely weakly speckled with darker buff in specimens of darkest coloration. The discoidal and marginal fields of the tegmina are of the general coloration, usually much suffused with a speckling of darker buff, these markings concentrating to form two weakly defined darker bands. The pronotum is normally greatly suffused with white except along the lateral borders of the dorsum and on the dorso-caudal portions of the lateral lobes with the characteristic small median depression very dark. The head is heavily suffused with white except for two narrow post-ocular bands. Antennae and limbs suffused with white, with two conspicuous dark bands on the caudal femora and the genicular areas of the same dark buffy. Inner faces of caudal femora yellowish, heavily twice banded with black but with genicular areas not at all or but little darkened. Caudal tibiae scarlet, this color fading to white near the proximal extremity. Wings with proximal portion marguerite yellow individually varying to reed yellow, margined distad with a broad continuous black band, this not interrupted normally except very briefly before the elongate spur. Remaining distal portion of wings hyaline with tip often weakly suffused with black. Immature individuals are even more heavily suffused with white but with color pattern (darker narrow post-ocular bars, margining of disk of pronotum and bands of caudal femora) strongly defined.

The species was found widely distributed but few in numbers everywhere along the middle and upper ocean beaches at Miami Beach. Individuals were encountered without exception on loose sand either along the landward border of the middle beach or less often immediately back of this in areas

[9] Of this series the two largest specimens were taken in September.

of high seaside oats, *Uniola paniculata*. At Palm Beach a few individuals were observed under similar conditions. The flight of this insect much resembles that of *maritima* and is more direct than that of *citrina*.

Specimens examined: 79; 38 males, 23 females, 7 immature males and 11 immature females. Capron,[10] IV, 10 and 19, 2 ♂, 1 ♀, [U. S. N. M.] Palm Beach, III, (A. N. Caudell), 1 ♂, 1 ♀, [U. S. N. M.]; III, 8, 1915, (H.), 1 ♀, 1 juv. ♂. Miami Beach, III, 7 and 12, 1915, (H.), 30 ♂, 17 ♀, TYPE, *allotype* and *paratypes*, 6 juv. ♂, 11 juv. ♀; IX, 23, 1913, (W. T. Davis), 5 ♂, 3 ♀, *paratypes*, [Davis Cln.].

Stenacris vitreipennis (Marschall). Southside, Miami, III, 6, 1915, (H.; dry undergrowth of pine woods), 2 ♂, 1 ♀.

It was surprising to find these specimens in the above situation as we had hitherto always found the insect only in reeds growing out of water in swamps, marshes and sink-holes.

Leptysma marginicollis (Serville). Miami Beach, III, 12, 1915, (H.; boggy depression on palmetto flats), 1 ♂. Southside, Miami, III, 16, 1915, (H.; dry undergrowth of pine woods), 3 ♂, 1 ♀.

The comment made upon the last species, applies to some of these specimens as well. This species, however, usually prefers reeds on boggy ground rather than those growing out of water.

Schistocerca serialis (Thunberg).

Schistocerca americana of authors.

Drury in 1775 described and figured this species as *L[ibellula] americana*, Ill. Nat. Hist., I, p. 128, pl. xlix, fig. 2, name in index. This is preoccupied by *Libellula americana* of Linnaeus, Syst. Nat., ed. x, p. 545, 1758. The next name to apply to Drury's *L. americana* is *Gryllus serialis* of Thunberg, Mém. Acad. Imp. Sci., St. Petersbourg, V, p. 241, 1815, described from St. Bartholomew, British West Indies, which name consequently must be used for this species.

Miami Beach, III, 7, 1915, (H.), 1 ♂. South of Brickell's Hammock, Miami, III, 3, 1915, (H.), 1 ♀.

This species was found occasional through the pine woods, in the hammock and frequently in considerable numbers in the vegetation back of the sea beaches.

[10] This refers to the abandoned Fort Capron, which was located near the present town of Viking.

Schistocerca damnifica calidior Rehn and Hebard. Southside Miami, III, 6, 1915, (H.; occasional through undergrowth of pine woods), 8 ♂, 1 ♀.

Eotettix signatus Scudder. South of Brickell's Hammock, Miami, III, 3, 1915, (H.; edge of salt marsh), 1 very small juv. ♂, 1 very small juv. ♀. Homestead, III, 17 to 19, 1910, (H.; edge of everglades), 3 very small juv. ♂.

These tiny specimens in no way resemble the adult insect, but would rather suggest the immature condition of some remarkable tropical form. The generic status is, however, certain from specimens before us showing other immature instars, and, as *signatus* is very abundant in this region and situation later in the season and the only species of the genus known from southern Florida, there seems little doubt of the proper specific identity.

Melanoplus puer Scudder. Miami Beach, III, 7 and 12, 1915, (scarce and local in beach vegetation back of strand), 4 ♂, 2 ♀. Southside, Miami, III, 6 and 16, 1915, (H.; widely distributed and locally common in undergrowth of pine woods), 14 ♂, 8 ♀. Virginia Key, III, 11, 1915, (H.; in beach vegetation back of strand), 1 ♀. Cape Florida, Key Biscayne, III, 12, 1915, (H.; back of beach in low strand vegetation), 1 very small juv. ♂.

The specimens from Miami Beach average slightly larger than those from the mainland.

Paroxya atlantica atlantica Scudder. Southside, Miami, III, 16, 1915, (H.; adults occasional, young abundant in undergrowth of pine woods near hammock), 1 ♂, 1 ♀. South of Brickell's Hammock, Miami, III, 3, 1915, (H.), 2 ♂, 1 ♀.

Aptenopedes sphenarioides clara Rehn.[11] Miami Beach, III, 7 and 12, 1915, (H.; adults locally common, young in early stages generally more numerous, back of beach in low strand vegetation), 16 ♂, 12 ♀, 1 juv. ♂, 1 juv. ♀. Southside, Miami, III, 6, 1915, (H.; occasional in undergrowth of pine woods), 2 ♂, 3 ♀, 2 juv. ♂, 1 juv. ♀. Brickell's Hammock, Miami, III, 3, 1915, (H.; luxuriant undergrowth in opening of ham-

[11] Study of other Floridian geographic races and the large series of this insect in the collections before us offers convincing evidence of the racial status of *clara*. It is our opinion that absolutely intermediate material, proving this relationship, will be found in north central Florida when that region is investigated.

mock), 1 very small juv. ♂. Virginia Key, III, 11, 1915, (H.; back of strand in low beach vegetation), 1 juv. ♂. Cape Florida, Key Biscayne, III, 12, 1915, (H.; luxuriant vegetation in clearing), 1 ♂.

This series is of particular interest, owing to the added evidence which we have from it on the decided size variation in this race, due wholly to local environmental conditions. Males previously taken on Key Biscayne and the present specimen from that locality average decidedly larger than any other series we have seen, while the material from Miami Beach also averages distinctly larger than that from the pine woods near Miami.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
Miami Beach (16).....	22. -24	4.2-4.8	3.7-4.7	11.8-13
Southside, Miami (2).....	20.3-21.7	3.9-4.1	4.1-4.4	11.3-11.7
Key Biscayne (3).....	25.3-27.4	5.2-5.8	5.6-5.9	14.3-16
♀				
Miami Beach (12).....	30. -34.9	5.7-6.7	5.2-5.6	14 -17.3
Southside, Miami (3).....	26. -26.7	5.1-5.2	4.7-5	12.9-13.7
Key Biscayne (3).....	31.7-34.3	6.1-6.8	5.8-6.8	14.6-16.9

The males before us are all green, or green suffused with reddish. The females exhibit wood brown, ferruginous brown and green color phases.

Aptenopedes aptera Scudder. Southside, Miami, III, 6 and 16, 1915, (H.; occasional especially about low bushes in undergrowth of pine woods), 3 ♀, 3 small juv. ♂, 1 juv. ♀.

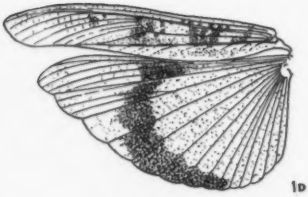
One of these females is as large as any of the species we have seen; length of body 33; of pronotum 7.7, of caudal femur 15.9 mm.

EXPLANATION OF PLATE XVIII.

Fig. 1A. *Trimerotropis acta* new species. Miami Beach, Fla. Female (TYPE). Lateral view. (X1½).
Fig. 1B. The same. Cephalic outline of head. (X2).
Fig. 1C. The same. Lateral outline of pronotum. (X2).
Fig. 1D. The same. Figure of tegmen and wing. (X1½).
Fig. 1E. *Trimerotropis acta* new species. Miami Beach, Fla. Male (*allotype*). Figure of tegmen and wing. (X1½.)
Fig. 2A. *Oligacanthopus prograptus* Rehn and Hebard. Miami, Fla. Male (*allotype*). Dorsal view. (X4.)
Fig. 2B. The same. Head, cephalic aspect. (Greatly enlarged).

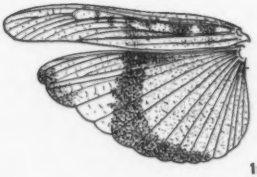
1A

1B



1D

1C



1E

2A

2B

MIAMI, FLORIDA, ORTHOPTERA—HEBARD.

Notes on Bombidae, with Descriptions of New Forms (Hym.).

By Henry J. Franklin, Massachusetts Agricultural College, Amherst, Mass.

In this paper, I present descriptions of the new American forms of *Bombus* and *Psithyrus,* of which I have seen representatives and also the new records of distribution which I have accumulated since the appearance of my monograph of the Bombidae of the New World. (Trans. Amer. Ent. Soc. xxxix, 1913).

Bombus (Bombus) alboniger new species.

Types: The queen and male described below came from Cerro Zunil, Guatemala (4,000 to 5,000 ft. alt.), having been collected by G. C. Champion. The worker type came from Irazu, Costa Rica (6,000 to 7,000 ft. alt.—H. Rogers, collector). All these specimens, together with a queen paratype from Cerro Zunil, are deposited in the collection of the British Museum.

Pile of medium length and rather fine. Head mostly dark. Sides of thorax white; its dorsum, except the scutellum, mostly black. Abdomen with the first dorsal segment and the middle of the second white, otherwise entirely black.

Queen. Head.—Face entirely dark; occiput black, but with a faint admixture of very fine pale yellow hairs; cheeks entirely dark. Malar space somewhat shorter than its width at apex, about one-fifth as long as the eye. Clypeus rather sparsely punctate over the disc with rather coarse punctures.

Thorax.—Dorsum mostly black, but with a very noticeable triangular spot of yellow pile just back of the head and with the hind margin of the scutellum clothed heavily with white pile. Mesopleura from the bases of the wings to the bases of the legs, metapleura and sides of median segment clothed with white pile.

Abdomen.—Dorsum: Segment one clothed with pure white pile; segment two black on the sides, but with a wide patch of white pile running across its middle part (this patch being widest—more than two-thirds of the entire width of the abdomen at that place—at the front margin of the segment and growing rapidly narrower until it reaches the hind margin—where it is about one-third as wide as the segment); segments three to six inclusive entirely black. Venter dark.

Wings.—Only moderately infuscate; about like those of the *ephippiatus* queen; the fore pair lightest across their middle portions.

Legs.—The trochanters mostly dark, but with a slight sprinkling of light hairs on their lower sides; the femora black, but with a few pale hairs at their very bases on the lower side; corbicular fringes black.

Worker.—Much like the queen, but with lighter, subhyaline wings; the triangular spot of light pile on the dorsum of the thorax just back of the head white instead of yellow.

Male. Head.—Face well clothed with gray pile (a mixture of long black hairs and shorter white ones); occiput with much whitish pile in the middle but with only black hair on the sides; upper part of cheeks entirely dark, but their lower part with much light pile. Mandibles with a heavy ferruginous beard. Length of malar space and its width at apex about equal. Clypeus well covered with pile.

Thorax.—Coloration of pile much like that of worker, but the clothing of the scutellum mostly white and a line of white pile running across the dorsum at its front margin.

Abdomen.—Coloration of dorsum like that of worker. Apical margins of the ventral segments fringed with light hairs.

Legs.—Coxae and trochanters densely fringed with white pile on their lower sides; femora entirely dark except for a few pale hairs at their very bases; hind tibiae with long ferruginous fringes (hairs) and with their outer faces sparsely hairy.

Dimensions.—Length: queen, 19 mm.; worker, 11 mm.; male, 12 mm. Spread of wings: queen, 39 mm.; worker, 25 mm.; male, 26 mm.

This species belongs to the *pratorum* group (I have examined the tips of the genitalia, which are slightly extruded in the type specimen) and seems to be closely related to *pulcher* Cress. The appearance of this species is very striking, its black and white pile contrasting sharply.

Bombus nigrodorsalis Franklin.

Five queens and two workers of this species, which were sent to me for determination by G. Meade-Waldo, of the British Museum, show sufficient evidence by their marked variation in coloration to justify the conclusion that *nigrodorsalis* Franklin and *montezumae* Ckll. are color variants of the same species rather than distinct species. The name *nigrodorsalis* has priority.

These specimens provide the following new habitat records for the species: Ciudad, Mexico, 8,100 ft. (2 queens, Forrer coll.); Omilteme, Guerrero, Mexico, 8,000 ft. (1 queen, H. H. Smith coll.); Xucumanatlan, Guerrero, Mexico, 7,000 ft. (1

queen, H. H. Smith coll.); Quezaltenango, Guatemala, 7,000 ft. (2 workers, G. C. Champion coll.).

The malar space of the females of this species is only a little more than one-fourth as long as the eye, and that of the male is fully a fourth as long as the eye. The third antennal segment of the male is only a little longer than the fourth. The male before me has the fourth dorsal abdominal segment entirely dark except for a faint fringe of very short pale hairs along its apical margin, the fifth segment dark except for a strong fringe of ferruginous hairs along its apical margin, and the sixth and seventh segments with mostly ferruginous pile.

Bombus trinominatus D. T.

There are three queens of this species from the collection of the British Museum before me, all from Omilteme, Guerrero, Mexico, 8,000 ft. alt. (H. H. Smith).

These specimens are from 17 mm. to 18 mm. in length. They have the apical margin of the fifth dorsal abdominal segment fringed with ferruginous pile and the clothing of the sixth dorsal segment is mostly of the same color. This fringe of the fifth segment and clothing of the sixth are, without doubt, normally ferruginous, instead of yellow as they have previously been described. The apical margins of the four middle ventral segments are fringed for the most part with pale hairs.

Bombus brachycephalus Handl.

There are four queens of this species from the collection of the British Museum before me. Two of these specimens (from Omilteme, Guerrero, Mexico, 8,000 ft. alt.), are typical in their characters, and, as the description of the females of this species given in my monograph. (Trans. Amer. Ent. Soc. xxxix, 1913, p. 143) is meagre. I will describe the queen more in detail here:

Queen. Head.—Face mostly black, but the frons with a general, though inconspicuous, admixture of short stramineous pubescence. Occiput and cheeks entirely dark. Malar space distinctly shorter than its width at apex, slightly more than one-sixth as long as the eye. Clypeus moderately and coarsely punctate. Ocelli large and placed considerably below the supra-orbital line, almost exactly in the narrowest part of the vertex, the lateral ones being much nearer to the margins of the eyes than to each other. Flagellum of antenna about one and two-thirds times as long as the scape.

Thorax.—Entirely black. A large area around the center of the dorsum naked, smooth and shining.

Abdomen.—The three basal segments of the dorsum entirely black and the three apical ones clothed with ferruginous pile. Venter black except for the ferruginous hair fringing the apical margin of the fifth segment and clothing the sixth.

Wings.—Very dark, with violaceous reflections.

Legs.—Coxae, trochanters, femora, fore and middle tibiae and corbicular fringes (hairs) all black.

Dimensions.—Length, 18 mm. to 19 mm.; spread of wings, 45 mm. to 46 mm.

The other two queens before me show a marked variation from the typical form, and I here establish two color variants on the characters shown by them:

Color Variant 1.—Like the typical queen, but with the fourth dorsal abdominal segment clothed entirely with black pile, the fifth dorsal segment with considerable black hair on its middle portion, especially toward the base, and the clothing of the epipygium black except on the extreme sides.

Queen from El Jicaro, Vera Pás, Guatemala (Champion).

Color Variant 2.—Like the typical queen, but with the fourth dorsal abdominal segment clothed entirely with black pile, the fifth segment entirely dark except for a touch of light ferruginous hair on each hind corner, the epipygium entirely dark except for a few scattering ferruginous hairs on the sides, the fifth ventral segment with no apical fringe of ferruginous hairs, and the hypopygium without ferruginous clothing except at its very apex.

Queen from San Geronimo, Guatemala (Champion).

Bombus (Bombias) weisi Friese.

A male before me, collected by C. H. T. Townsend at Huascaray, Peru (6,500 ft.), because of its structural characters, its form and the character of its pile, seems to me to represent a male color variant of this species. It differs strikingly from the typical male described by me in "The Bombidae of the New World," in the following respects:

General color much darker; occiput of head with mostly black pile; face with much black hair admixed, especially around and above the bases of the antennae; dorsum of thorax with a very broad black band between the bases of the wings, a narrow band of yellow running across the front and the scutellum bearing a considerable hind border of yellow hair; pleura and sides of median segment with entirely dark pile; second dorsal abdominal segment with entirely dark pile; a few scattering white hairs present on the sixth and seventh dorsal segments; the legs with no yellow pile; the wings rather dark.

I received this specimen through the kindness of Prof. T. D. A. Cockerell.

Psithyrus intrudens (F. Sm.) Handl.

A female of this species from the collection of the British Museum is before me. It bears two locality labels—"Santa Cruz" and "San Geronimo, Guatemala (Champion)." This species is much like *laboriosus* in general appearance, the only noticeable difference between it and the specimens of that species without any yellow on the dorsum of the abdomen being the shaded lower portions of its pleura and the greater amount of yellow in the pile of the frons above the bases of its antennae. It can be readily separated from *laboriosus* structurally, however, by its much finer pile and by the much finer and sparser punctuation of the dorsum of its abdomen, the abdomen being scantily clothed and shining much like that of *variabilis*.

Psithyrus bicolor Franklin.

A specimen before me, from Xucumanatlan, Guerrero, Mexico (7,000 ft. alt.), seems much like the type of this species, except that the disc of the dorsum of its thorax is not noticeably darkened, its second dorsal abdominal segment has no yellow pile whatever on its hind corners, the yellow on the hind corners of its third segment does not extend toward the middle line along the hind margin and its fourth segment has no yellow pile whatever in the middle. The punctuation of the dorsum of its abdomen is about like that of *intrudens*, being much finer and sparser than that of *insularis*. This specimen may represent a new species, but I prefer not to give it a new name until I know more about the variations of the Mexican and Central American *Psithyri*.

I have the following new habitat records for New World species of *Bombus* and *Psithyrus*:

1. **Bombus terricola** Kirby. Fargo, No. Dakota, forty-two specimens, representing all three castes; Detroit, Minnesota, three workers; Lake Park, Minnesota, four males and one worker (all by O. A. Stevens).
2. **Bombus affinis** Cresson. Fargo, No. Dakota, one worker (O. A. Stevens).

3. **Bombus borealis** Kirby. Fargo, No. Dakota, one queen, one worker and four males; Detroit, Minnesota, one queen; Moorhead, Minnesota, one queen (all by O. A. Stevens).
4. **Bombus impatiens** Cresson. Lake Park, Minnesota, two workers (O. A. Stevens).
5. **Bombus ternarius** Say. Fargo, No. Dakota, twenty specimens, representing all three castes; Medora, No. Dakota, one queen; Lake Park, Minnesota, one worker and four males (all by O. A. Stevens).
6. **Bombus huntii** Greene. Sentinel Buttes, No. Dakota, one qeeen (O. A. Stevens).
7. **Bombus perplexus** Cresson. Fargo, No. Dakota, one queen (O. A. Stevens).
8. **Bombus californicus** Smith. Beaver Creek, Montana, 6300 ft. alt., two workers (S. J. Hunter).
9. **Bombus pennsylvanicus** Geer. Fargo, No. Dakota, one queen and three workers (O. A. Stevens); Jalisco, Mexico, one male (Schumann).
10. **Bombus sonorus** Say. A queen without label, said, apparently on good authority, to have been collected in Sonoma County, California. Northern Sonora, Mexico, one queen and two workers (Morrison).
11. **Bombus nevadensis** Cresson. Dickinson, No. Dakota, one queen and one worker (O. A. Stevens).
12. **Bombus rufocinctus** Cresson. Fargo, No. Dakota, two workers and two males; Detroit, Minnesota, two queens (all by O. A. Stevens).
13. **Bombus ephippiatus** Say. Purula, Guatemala, one worker and one male; V[olcan] de Chiriqui, 2,000 to 3,000 ft. alt., two workers (Champion). Rio Sarstoon, British Honduras, one worker.
14. **Bombus pulcher** Cresson. Xucumanatlan, Guerrero, Mexico, 7,000 ft. alt., one worker (H. H. Smith). Orizaba, Mexico, one queen and four workers (H. H. S. and F. D. G.). Santa Cruz, Guatemala, one queen; San Geronimo, Guatemala, one queen; Capetillo, Guatemala, one queen (Champion). Ciudad, Mexico, 8,100 ft. alt., one queen (Forrer). Omilteme, Guerrero, Mexico, 8,000 ft. alt., two workers.
15. **Bombus wilmattae** Cockerell. Quezaltenango, Guatemala, 7,800 ft. alt., two workers and one male (Champion).
16. **Bombus emiliae** Dalla Torre. Ocampo, Argentina, two workers.
17. **Bombus steindachneri** Handlirsch. Chilpancingo, Guerrero, Mexico, 4,600 ft. alt., one queen and one worker; Amula,

Guerrero, Mexico, 6,000 ft. alt., one queen and one worker; Acaguizotla, Guerrero, Mexico, 3,500 ft. alt., two workers and one male; Tepetlapa, Guerrero, Mexico, 3,000 ft. alt., one worker (all by H. H. Smith). Jalisco, San Blas, Mexico, two workers; Tepic, Mexico, one worker (all by Schumann). Ventanas, Mexico, 2,000 ft. alt., one worker (Forrer).

18. **Bombus dolichocephalus** Handlirsch. Amula, Guerrero, Mexico, 6,000 ft. alt., one queen; Xucumanatlan, Guerrero, Mexico, 7,000 ft. alt., one worker; Acaguizotla, Guerrero, Mexico, 3,500 ft. alt., one worker (all by H. H. Smith). Tepic, Mexico, one queen; Jalisco, Mexico, one queen (both by Schumann).
19. **Bombus niger** Franklin. Monte Alegre, Lower Amazon, Brazil, one worker (E. E. Austen). Bugaba, Panama, two workers (Champion).
20. **Bombus medius** Cresson. Para, Brazil, one queen (E. E. Austen). Valladolid, Yucatan, Mexico, one worker (Gaumer). Jalapa, Mexico, one worker (F. D. G.). Teapa, Tabasco, Mexico, one queen (H. H. Smith). San Geronimo, Guatemala, one worker and one male; Bugaba, Panama, 800 to 1,500 ft. alt., one male (all by Champion).
21. **Bombus mexicanus** Cresson. Guatemala City, Guatemala, one worker (W. P. Cockerell).
22. **Bombus volucelloides** Gribodo. Rio Sucio, Costa Rica, one queen (H. Rogers). Omilteme, Guerrero, Mexico, 8,000 ft. alt., one worker (H. H. Smith).
23. **Bombus funebris** Smith. Pachacayo, Peru, over 12,000 ft. alt., one male (C. H. T. Townsend).
24. **Bombus coccineus** Friese. Pachacayo, Peru, over 12,000 ft. alt., one worker (C. H. T. Townsend).
25. **Psithyrus laboriosus** (Fabricius) D. T. Fargo, No. Dakota, two males; Kathryn, No. Dakota, one female; Lake Park, Minnesota, one male (all by O. A. Stevens).
26. **Psithyrus insularis** Smith. With the new evidence produced by Sladen (Can. Ent. xlvii, 1915, page 84) in mind, I now regard *consultus* as being the male of this species without question. Fargo, No. Dakota, two males (O. A. Stevens).
27. **Psithyrus variabilis** (Cresson) D. T. Orizaba, Mexico, one male (H. H. S. and F. D. G.). Fargo, No. Dakota, one male (O. A. Stevens).
28. **Psithyrus ashtoni** (Cresson) D. T. Fargo, No. Dakota, one female and three males; Lake Park, Minnesota, three males (all by O. A. Stevens). New Jersey, two females (G. C. Crampton).

29. **Psithyrus latitarsus** Morrill. Creede, Colorado, 8,844 ft. alt., one female (S. J. Hunter).

30. **Psithyrus suckleyi** (Greene). Creede, Colorado, 8,844 ft. alt., three males (S. J. Hunter).

The following differences, in addition to those given in my monograph of the Bombidae, should be noted as distinguishing the females of the three American groups of *Psithyrus*:

1. *The Laboriosus Group.* Females with the sides of the fifth dorsal abdominal segment moderately punctate and its middle portion either impunctate or sparsely or moderately punctate; the middle portion of the exposed part of the sixth dorsal segment more or less punctate.

2. *The Ashtoni Group.* Females with sides of fifth dorsal segment very densely punctate, the dense punctuation extending nearly to the middle line on the hind part of the segment a little in front of the apical margin; the middle part of the exposed portion of the sixth dorsal segment only sparsely punctate at most.

3. *The Fernaldae Group.* Females with fifth dorsal segment impunctate in the middle, except for a few punctures in front of the apical margin, and sparsely to moderately punctate on the extreme sides; the middle part of the exposed portion of the sixth dorsal segment practically impunctate.

In a collection of bumblebees recently received from Mr. A. S. Skorikov, of Petrograd, Russia, and named by him, I find the following interesting records of capture at high altitudes: *Bombus morawitzi* Rad., ♀, Pamir, Turkestan, 15,000 ft.; *Bombus regeli* F. Mor., ♂, Bucharei, Turkestan, 12,500-13,000 ft. I also find that the following species represented in this collection belong to the sub-genus *Bombias*: *regeli* F. Mor., *niveatus* Kriechb., *incertus* F. Mor. The females of *niveatus, incertus* and *apollineus* Skor. present the most remarkable case of a parallel development in coloration of species not at all closely allied, with which I am familiar, their coloring, especially that of the first two species, being almost exactly alike. They can be readily separated structurally, however. The female *niveatus* has a long malar space (much longer than its width at the apex—a remarkable character for *Bombias*), and its ocelli are large and placed considerably below the supra-orbital line, in the narrowest part of the vertex. The female *incertus* has a short malar space (slightly shorter than its

width at apex), and its ocelli are large, but placed not far below the supra-orbital line. The female *apollineus* has a short malar space (about like that of *incertus*), but its ocelli are small, and the sides of its head behind the eyes are much more densely punctate than those of *incertus*.

The eyes of the *niveatus* male are considerably swollen, and its ocelli are placed at somewhat less than one-third of the distance from the supra-orbital line toward the bases of the antennae, being slightly above the narrowest part of the vertex. Each of its lateral ocelli is a little less than its own diameter from the nearest eye-margin. The size and relative position of the eyes and ocelli of the male of *regeli* are about the same as with the *niveatus* male.

The Occurrence of Striking Peculiarities of Pattern in Unrelated Chalcidoid Hymenoptera.

By A. A. Girault, Washington, D. C.

In North Queensland I chanced upon the following examples of the occurrence of striking and peculiar color patterns in unrelated Hymenoptera of the Chalcidoid series. There is a number of very beautiful chalcid flies which have the head and thorax metallic green or purple and the abdomen deep golden yellow, margined down all, or part, of each side by the metallic color. The peculiarity and unusualness of this kind of pattern is such as to catch the eye at once and the first species which I encountered was subsequently thought to be very common from the fact that the pattern was taken as the index of identity. However, later, these specimens were closely examined and resulted as follows:

A pirene miscogasterid, a eupelmid, an encyrtid, an aphelinine (*Encarsia*) and several other Eulophidae representing two undescribed tetrastichine genera (two species in one of them), an *Aprostocetus*, an *Ootetrastichus* and a *Tetrastichus*. Here we find represented three families of the series, five subfamilies, nine genera and ten species. The habits of none of

these are known, but at least one must be a coccid parasite, and it is hardly likely that any of the species are associated or that the coloration has any significance from the standpoint of mimicry, or what may be called protective association. Most of these species are forest insects, but at least a third appear to be peculiar to jungle country. They were all captured at varying times and places (mostly near Nelson), and one of the tetrastichines was reared from a gall on a typical forest tree. These are, therefore, prominent examples of what may be called analogical likenesses or the development of similar characters among diverging lines of evolution.

Among the Mymaridae a *Gonatocerus* with banded wings is indeed a rarity or peculiarity more especially when the band takes the longitudinal rather than the transverse direction. There occur in North Queensland several large species of odd habitus as concerns the genus, two of which are very much alike and bear in the forewing a conspicuous longitudinal stripe; these two species are rather commonly met with in the jungle, but one day while sweeping in a jungle pocket at Meerawa I caught what I thought was another specimen of one of them and consequently was not particularly interested until upon examining the collection later I was surprised beyond the ordinary to find that the specimen was a *Polynema*. These three species belong to the jungle and the *Polynema* is as peculiar to its own genus as the other two are to theirs. Species of *Polynema* from the jungle quite frequently bear transverse stripes on the forewings, some of them very broad and conspicuous, in this case really and truly remarkable and wonderfully beautiful insects, but I have never seen a second member of the genus with a longitudinal stripe.

This occurrence of striking patterns of color in unrelated insects seems to be due merely to what may be expressed as chance variations, being preserved because they do not disturb the economy of the insects in question, and not to any significant mimetic or other interrelations between the species. I see no reason why this is not the explanation. The variation occurs and is preserved.

Another Migratory Moth (Lep.).

By J. R. WATSON, Florida Agricultural Experiment Station, Gainesville, Florida.

During the past year the writer has been working on the life history and distribution of the noctuid moth *Anticarsia gammatilis*. This study has resulted in some rather interesting discoveries. The caterpillars are a great pest of one of our most valuable leguminous forage and soil-improving plants, the velvet bean (*Stizolobium* sp.). It attacks also the kudzu vine and the horse bean (*Cannavalia*).

Neither the caterpillars or the moths make their appearance about Gainesville until August, and usually do not become sufficiently abundant to cause material damage until the first of September, although the velvet beans are large enough to seem to be attractive as early as May. Hence one of the questions that we set out to solve was, Where are the insects from early December until August? There seemed to be three possible answers. Stated in the order of their seeming probability, they were:

(1) The caterpillars and moths are present during at least the spring and early summer but in such diminished numbers as to escape attention; the caterpillars perhaps feeding on some wild legume.

(2) The insect remains in the pupa stage until late July or August.

(3) The insect dies out each winter to again come up from the south each summer.

1. A careful search has been made during the past two seasons for both the moths and the caterpillars during the first seven months of the year. The fields and woods have been carefully searched every few days and moth traps maintained at night. This search has yielded uniformly negative results. Not a single moth or caterpillar has been seen before August.

2. Hundreds of caterpillars were reared in the laboratory during October and November with special care to protect them from "cholera," a fungus disease due to *Botrytis rileyi*. These pupae and others collected from the field were placed in

an outdoor insectary under as nearly natural conditions as possible. The last moth to emerge from these pupae came out early in January. All that remained after that date failed to emerge at all, and investigation a little later showed that they were all dead. Careful search through the velvet bean fields in January failed to discover any live pupae. The last moths to be seen on the wing out of doors were flying late in December.

3. There seemed to be left only the third possibility. This led to an investigation of the insect's distribution and dates of appearance in other localities. There was little found on this subject in literature. Holland in "The Moth Book" gives the distribution as the "Mississippi Valley." Dyar in his list gives it as "Atlantic States." Over fifty circular letters were sent out to students of lepidoptera in the eastern United States, most of whom replied. To sum up the answers we get the following results: No one north of the Gulf States had seen the larvae. The moths have been taken as far north as Ontario, but, with one exception, all of these moths captured in the North were taken from late September to November.

I could find no record of the capture of the moth in the New England States. In the Northern States it seems to be most frequently taken in western Pennsylvania and Ohio, *i. e.*, directly north of Florida. All the available evidence seems to indicate that *Anticarsia gemmatilis* is a mere wanderer in the Northern States like *Alabama argillacea*.

Velvet beans in the western part of Florida are not greatly troubled, and both Prof. Worsham in Georgia and Dr. Hinds in Alabama inform me that they have never noticed the caterpillars.

Turning next to south Florida, we find quite a different condition of affairs. The insect begins to do serious damage to velvet beans in the Miami section in July, at least six weeks earlier than at Gainesville. On June 30, 1915, the writer found the moths to be present in the fields at Winter Haven in Polk County, 28° N. The moths were all badly rubbed, indicating that they were old. They were not at all abundant. No larvae were seen nor was there any indications of their work on vel-

vet beans. The moths had evidently just arrived. An equally careful search at Tavares in Lake County (a little below the 29th parallel) the next day gave entirely negative results, as did a very careful search at Gainesville (about 29 deg. 40 min.) on July 2.

The following data from the manuscript of Mr. Grossbeck were supplied to me by Mr. Frank E. Watson, of the American Museum of Natural History: "The moth was taken at South Bay, Lake Okeechobee, on April 29 and 30. Extends northward to Staten Island, westward to Wisconsin and Texas and so southward through Mexico and the Antilles to South America."

It does not seem, however, to be generally abundant in the West Indies. Several correspondents in Porto Rico report that it is not troublesome there or that they have never noticed it, but it is reported to be common in Cuba.

It seems therefore quite certain that the insect does not ordinarily winter over even in the central part of Florida, but works northward each summer from south Florida where one or more of its host plants are available for food at all seasons. It seems to be a sub-tropical insect ill adapted to regions of frost. There grows in south Florida a wild species of *Cannavalia* that could well be its original host plant as well as that of another species of the same genus, *A. ferruginea* Sm. Neither the velvet bean nor kudzu are native to Florida. We have here then a case of a native insect becoming a pest to an introduced plant.

With us, however, it is not the direct action of the cold that exterminates the insect. On November 21, 1914, the thermometer on the station grounds sank to 22° which is considerably lower than that usually recorded at any time during the average winter. Yet pupae lying exposed on the surface of the ground were not injured, and a number of moths were captured in the field, a few days later when the weather had moderated. The factor which prevents their enduring even the mild winter of the latitude of Gainesville is their imperfect hibernation. A few warm days in winter causes the moths

to emerge from the pupae, while the absence of food plants results in their death without progeny. If the insects could remain as pupae until April or even late March, they would, in many cases, find suitable host plants before death.

After the freeze of November 21 which killed their observed host plants, attempts were made to raise the caterpillars on some of the wild and cultivated legumes from the fields and woods. Although the caterpillars ate sparingly of some of these plants, alfalfa being one of the least disliked, they would not grow, and undoubtedly all would have died had not some velvet beans been raised in the greenhouse for them.

Their ability to reach such far northern stations as Canada is to be explained by their longevity. Some moths kept in a cage 4 x 4 x 5 feet and fed on moistened sugar lived for five weeks.

A detailed description of the larvae, their work, and the life history of the insect will be published in the next annual report of this station. Only a brief summary can be given here. In September the insect spends about three days in the egg stage and twenty-one in the larval, passing through six instars. The pupal stage averages between ten and eleven days in September. As the weather became cooler with the advance of the season, this time was gradually lengthened until those that pupated in November averaged twenty-one days, and two that pupated on November 20th and 21st issued on January 7th, forty-eight and forty-seven days, respectively.

The writer will be grateful for any additional records of the occurrence of this moth or its caterpillar.

Completion of the "Biologia Centrali-Americana."

The [London] *Times Literary Supplement*, of September 16, 1915, announces the appearance of the Introductory Volume of this work by Dr. F. D. Godman, saying: "The Introductory Volume, by the surviving editor, marks the completion of this monumental work on the natural history and archaeology of one of the most interesting areas on the earth's surface. The manifold departments have required for their investigation the labours of a whole army of the most eminent specialists, producing gradually in the course of 36 years 52 volumes of zoology, five of botany, and six of archaeology." We hope to present a more extended notice of the Introduction at a later date.

ENTOMOLOGICAL NEWS.

PHILADLPHIA, PA., NOVEMBER, 1915.

Jean Henri Fabre.

A telegram from Orange, France, dated October 11, 1915, published in the daily press, reads, "Henri Fabre, the entomologist, is dead."

What a life was his since first he saw the light at Saint-Léons, canton of Vezins, in the Haut Rouergue, on December 22, 1823! He himself wrote of it—

> a life...not exempt from many cares, yet not very fruitful in incidents or great vicissitudes, since it has been passed very largely, in especial during the last thirty years, in the most absolute retirement and the completest silence.

Most absolute retirement and completest silence account for much of his career. His positive dislike of most human society and intercourse, his infrequent letters even to his well-loved brother, his refusal to observe many of the ordinary conventionalities had much to do with the obscurity in which most of his life was spent. They explain why he remained for nearly twenty years (1853-1871) assistant professor of physics at the Lycée of Avignon without change in rank, title, or salary, the last amounting to £64 per annum. Fortunately, other sources of income became available, such as that derived from the conservatorship of the Requien Museum.

It was during the Avignon period that his entomological researches began with the *Étude sur l'instinct et les metamorphoses des Sphégiens* (1856), but the first series of the *Souvenirs Entomologiques* did not appear until 1879. Nine others followed, the tenth in 1908. An English translation of the first series, entitled *Insect Life Souvenirs of a Naturalist,* was published in 1901 and selections from the others have been included in *The Life of the Spider, Social Life in the Insect World, The Mason Bees,* etc. Nothing more fascinating in all entomological literature, and at the same time free from all technicality, can be found than Fabre, even though he has been

accused of "making deductions too rapidly from his observations and taking a philosophical position from which he refuses to budge." His biographer insinuates that he was as disregardful of much of the work of others in his chosen field as he was of humans in general.

When at last his genius was generally recognized at home as well as abroad, a jubilee held in his honor at Serignan, in April, 1910, and leaders in literature and science acclaimed his greatness, he was well over eighty. Yet in spite of the neglect, the poverty, the sorrows of a long life, Fabre could write from his Serignan hermitage, as he approached his eighty-eighth birthday—

> on reading now the old letters which he [my devoted disciple] has exhumed from a mass of old yellow papers.....it seems to me that in the depths of my being I can still feel rising in me all the fever of my early years, all the enthusiasm of long ago, and that I should still be no less ardent a worker were not the weakness of my eyes and the failure of my strength an insurmountable obstacle.

These words form part of the preface which he contributed to that appreciative volume *Fabre, Poet of Science*, by Dr. C. V. Legros, published in English dress in 1913.

Notes and News.

ENTOMOLOGICAL GLEANINGS FROM ALL QUARTERS OF THE GLOBE.

Some Rare California Butterflies (Lep.).

In the latter part of April, 1914, Mr. H. H. Newcomb and I made an automobile trip from Los Angeles through Elizabeth Lake and Mojave to Johannesburg in the Mojave Desert country. We saw but few butterflies in Bouquet Canyon, but at Elizabeth Lake, about forty miles south from Tehachapi and at a 3000 foot elevation, we caught a large number of *L. chlorina*. This is like *L. acmon*, but of a decided greenish blue color and quite different from the blue of *acmon*. Also, it is not at all like Clemence's *L. monticola* from the Mt. Wilson region, which is a lighter blue than *acmon*. A few of *M. gabbi* were taken here.

Passing into Antelope Valley, which is the western end of the Mojave Desert, at about 2200 feet elevation, we immediately commenced to get another form of *Melitaea* named *neumoegeni* by Dr. Skinner. A range of hills marked the line of demarcation betwen the two forms.

About twelve miles east of Mojave, on the line of the Southern Pacific Railway, we ran into a country covered with greasewood. The

open spaces were covered with myriad flowers and clumps of bunchgrass. Here we found Henry Edward's *L. speciosa* in abundance. This beautiful little insect is intensely blue with a broad black border and white fringe and with the under side marked like *L. polyphemus*, the spots being very large and heavy. The female has very little blue and looks almost black at first glance. I judge it to be a dwarfed, desert form of *L. polyphemus*, hardly larger than *exilis*, with the coloring and spots very strongly marked. They flew close to the ground and were occasionally taken clinging to the stems of bunchgrass. With their wings folded tight and the under side only showing, they were very much the same color as the grass, which was already bleaching under the desert sun.

At Johannesburg we took a few *L. speciosa*, a number *of M. neumoegeni*, several dwarfed desert specimens of *E. ausonides* and each of us took one *E. cethura*, form *morrisoni* (or perhaps W. G. Wright's form *deserti*). We also saw the tail end of an enormous flight of *P. cardui*, which covered all of Los Angeles County in February and March.

Altogether we had a very interesting trip through a fascinating and little traveled country. Generally one sees a number of coyotes and jack rabbits on this trip, but we saw none. We did, however, capture several desert tortoises, three rattlesnakes and a number of horned toads.—J. R. HASKIN, Los Angeles, California.

Cicindela unipunctata Fabr. at Seaville, New Jersey. (Col.).

Twenty-one specimens of this tiger-beetle were taken along a road at Seaville on August 12 and 16, 1915. The road was well shaded by pine and oak trees and exhibited several kinds of soil. The majority of the specimens were taken on dark, rich-looking earth, which occurs along the coast back of the marshes, but does not penetrate far into the State. At one time, when the road was more used, gravel was filled in along one stretch, and several specimens were taken here. In another place a narrow stretch of white sand occurred in an otherwise uninterrupted area of the black earth before mentioned and two specimens (in copulation) were taken on this. But very few of the whole number were taken on white sand. In my search I went back several miles inland and here the typical heavy Jersey sand began and *unipunctata* ceased. All the specimens were taken within two miles of the beginning of the road.

On the first date, August 12th, eleven specimens were taken. This was a bright, sunny morning and the sun's rays penetrated through the foliage overhead and struck the road in places, but *unipunctata* was never in these light places. On this occasion everyone of the eleven specimens was absolutely motionless when taken. Many of them showed no life until after they were put in the bottle. They were usually in or near the centre of the road, in the characteristic tiger-beetle

position, head somewhat higher than the body. They frequently resembled very closely the background of dead twigs and leaves and showed no more signs of life. Along the edges of the road in some places was a slight bank, and in this bank were often circular, irregular holes ranging from the size of a quarter to a half dollar. None of the specimens were taken near these holes, however.

On the second date, August 16th, the remaining ten specimens were taken in the afternoon. This time the day was rather cloudy, and several of the specimens were taken around five o'clock, when the road was considerably darker than on the previous occasion. These specimens were quite lively, running rapidly when approached, but never flying.

The rest of the insect life of this locality seemed to be limited mostly to *Cicindela punctulata* in large numbers, a few specimens of *C. consantanea* and wasps of the families Sphecidae and Mutillidae.—Wm. C. Thompson, Philadelphia, Pa.

Entomological Literature.

COMPILED BY E. T. CRESSON, JR., AND J. A. G. REHN.

Under the above head it is intended to note papers received at the Academy of Natural Sciences, of Philadelphia, pertaining to the Entomology of the Americas (North and South), including Arachnida and Myriopoda. Articles irrelevant to American entomology will not be noted; but contributions to anatomy, physiology and embryology of insects, however, whether relating to American or exotic species, will be recorded. The numbers in **Heavy-Faced Type** refer to the journals, as numbered in the following list, in which the papers are published.

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Clemens, W. A.—May flies of the Siphlonurus group [1 n. gen.; 1 n. sp.], **4,** 1915, 245-60. **Corbett & Hargreaves**—Vulturops floridensis, a new member of the Psocid subfamily Vulturopinae from the U. S., **5,** xxii, 142-3. **Hood, J. D.**—A new Hoplandrothrips (Thysanoptera) from British Guiana, **4,** 1915, 241-4. **Hood & Williams**—New Thysanoptera from Florida and Louisiana [2 n. gen.; 11 n. sps.], **6,** xxiii, 121-38. **Longinos Navas, R. P.**—Neuropteros nuevos o poco conocidos, **272,** xi, No. 23, 28 pp.

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Davis, W. T.—List of the O. collected in northern Florida in 1914 for the Am. Museum of Nat. History, with descriptions of n. sps. [2 new], **6,** xxiii, 91-101. **Hebard, M.**—The American species of the genus Miogryllus, **6,** xxiii, 101-21.

HEMIPTERA. **Berlese, A.**—La distruzione della "Diaspis pentagona" amezzo della Prospaltella berlesei, **169,** x, 151-218. **Crosby & Hadley, Jr.**—The rhododendron lace-bug, Leptohyrsa explanata, **179,** viii, 409-14. **Ege, R.**—On the respiratory function of the air stores carried by some aquatic insects (Corixidae, Dytiscidae and Notonecta), **351,** xvii, 81-124. **Leonard, M. D.**—The immature stages of the black apple leaf-hopper (Idiocerus provancheri), **179,** viii, 415-19. **Phillips, W. J.**—Further studies of the embryology of Toxoptera graminum, **447,** iv, 403-4. **Teodoro, G.**—Sui tubi malpighiani dei Lecanini, **169,** x, 15-19.

Davidson, W. M.—Little-known western plant-lice, I [2 new], **179,** viii, 419-29. **Metcalf, Z. P.**—A list of Homoptera of North Carolina, **486,** xxxi, 35-60. **Osborn & Drake**—Additions and notes on the Hemiptera-Heteroptera of Ohio; Records of Guatemalan Hemiptera-Heteroptera, with descriptions of new species, **143,** xv, 501-8; 529-541. **de la Torre-Bueno, J. R.**—Nota sobre Hemipteros del Chaco de Santiago del Estero, **60,** xxvi, 157-162.

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flies, **36,** 1915, 152-76. **Frohawk, F. W.**—Hibernated examples of Vanessa antiopa, **9,** 1915, 197. **Fruhstorfer, H.**—Beitrag zur morphologie der Prepona- und Agrias-Arten, **84,** xxxii, 45-7. **Mosher, F. H.**—Food plants of the gipsy moth in America, **344,** Bul. No. 250. **Siegler & Simanton**—Life history of the codling moth in Maine, **344,** Bul. No. 252. **Van Eecke, R.**—Bijdrage tot de kennis der Nederlandsche Lycaena-soorten, **516,** i, 22-31.

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Aldrich, J. M.—The deer bot-flies (genus Cephenomyia) [1 new], **6,** xxiii, 145-50. The dipterous genus Symphoromyia in North America [8 n. sps.], **50,** xlix, 113-43. **Brethes, J.**—Description d'un nouveau Syrphide; Description de six Cecidomyidae de Buenos Aires, **60,** xxvi, 97-8; 151-6. (See also under General.) **Dohanian, S. M.**—Notes on the external anatomy of Boreus brumalis, **5,** xxii, 120-3. **Enderlein, G.**—Dipterologische studien XV. Crepidohamma, eine neue Drosophilidengattung aus Brasilien, **38,** xxxiv, 185-6. **Felt, E. P.**—New gall midges [5 new], **179,** viii, 405-9. **Ludlow, C. S.**—A question of synonomy, **5,** xxii, 137-40. **Malloch, J. R.**—Flies of the genus Agromyza, related to A. virens [5 new]; Notes on the flies of the genus Pseudodina, with description of a

n. sp., **50**, xlix, 103-8; 151-2. **Osburn, R. C.**—Studies in Syrphidae—IV. Species of Eristalis new to America, with notes on others, **6**, xxiii, 136-45. **Schmitz, H.**—Over Zygomma Enderlein en Zygoneura Meigen, **215**, iv, 157-9.

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Doings of Societies.

Entomological Section, Academy of Natural Sciences of Philadelphia.

Meeting of September 23, 1915. Mr. Philip Laurent, Director, presiding. Nine persons were present.

General.—Mr. Frost mentioned Bayhead, New Jersey, as a good collecting place. Mr. Hornig spoke of collecting near Alloway, New Jersey, and exhibited the collection he had made at that place while on a two weeks' vacation at the end of July.

Lepidoptera.— Dr. Skinner exhibited an aberration of *Callosamia cynthia* taken in Philadelphia. The color was a deep smoky brown, with the white markings nearly obsolete.

Diptera.— Mr. R. C. Williams said he had been told that the ordinary vacuum cleaner nozzle will frighten house flies, but if the nozzle is made of glass the apparatus becomes very effective as a method of catching flies. He said practically the same method has been used to rid trees of insects.

Hymenoptera.- Mr. Laurent stated that last March he had secured the trunk of a Norway maple containing numbers of the larvae of *Tremex columba*. The first specimens emerged on June 16, two males. From the 16th to the 23d of June, seventy males emerged, but only three females. To the 26th of June, ninety-six males emerged and ten females. From the 27th of June until the 7th of July only nine males emerged, but 22 females. From the 8th of July until the 30th of August the insects continued to emerge, but only 25 specimens made their appearance during these fifty-four days. In all, one hundred and sixty-two specimens emerged, 119 males and 43 females. He was unable to find a sign of the cast-off pupa cases and had never seen a male specimen, except in collections, in the thirty-seven years he has been collecting, and said other collectors had had the same experience. The insects could not be made to fly, although many ways were tried. When a female was dropped from the hand, from a point ten feet above ground, it would only flop to the ground. With the males it was somewhat different; when they left the hand they would sail downward like a flying squirrel, until they hit a tree trunk or some other obstruction.

Although males and females were kept in a separate cage they could not be induced to copulate and none copulated in the main cage containing the log. He had also reared from the log eleven males and five females of the parasite, *Megarhyssa lunator,* as well as a male and female of *M. greenei* Viereck. The sixteen specimens of *lunator* emerged between May 8th and 12th. He said *lunator* was not an internal parasite on *Tremex columba* but an external one, and commented on the proportion of parasites to host, 18 to 162.

Coleoptera.— Mr. G. M. Greene referred to the desirability of mounting Coleoptera to show both the upper and under side and

exhibited mounts designed for that purpose. The insects were suspended by steel wires, in a cardboard box, with glass above and below. This method shows large exotic species in an admirable manner. Mr. Laurent exhibited twenty-one specimens of *Cicindela unipunctata*, taken in two days by Mr. W. C. Thompson, at Seaville, New Jersey. —HENRY SKINNER, *Recorder.*

Feldman Collecting Social.

Meeting of June 16, 1915, held at the home of Frank Haimbach, 8406 Ridge Avenue, Roxborough, Philadelphia. Fifteen members and two visitors were present. President Wenzel in the chair.

General.- Mr. Hornig said he had taken a trip to Alloway, New Jersey, on May 30, expecting to get many things in this good collecting spot, as it was such a fine day, but had collected only 33 specimens; these were exhibited. Dr. Castle said he had had a delightful time on his recent Florida trip, but as there had been cold weather, frost and then rain before he reached there, collecting was poor.

Coleoptera. Dr. Skinner said he had never noticed before that the Rose Chafer *Macrodactylus subspinosus* Fabr. was injurious to anything but roses. At his place in Narberth they have done tremendous amount of damage to his cherry trees, not only eating the leaves but the fruit as well; had counted 15 on two cherries. Mr. Kaeber said he had cut from a tree (apparently dead for several years) at Upper Darby, Pennsylvania, May 23, a fresh pair of *Leptura mutabilis* Newm. which is rare about here. Also found infested sumac at same place, which had been burned over last fall. Took some of the twigs home and on May 27 a specimen of *Liopus fasciculatis* Harr. emerged, and they are still emerging. He has reared same species from oak twig taken at Woodbury, New Jersey, June 1, 1906. Mr. H. A. Wenzel exhibited *Polygraphus rufipennis* Kirby and *Hypophloeus tenuis* LeC. from Cobb's Creek, Pennsylvania, June 6, collected in white pine, and stated he had found both species under the same conditions at Pocono Mountains, Pennsylvania, August 10.

Lepidoptera and Hymenoptera. Mr. Daecke stated that while at Wildwood Park, near Harrisburg, Pennsylvania, June 12, he had found a last season's cattail, which he had taken home and from which bred *Dicymolomia julianalis* Wlk. and *Ypsolophus bipunctellus* Wlsm. and a Hymenopterous parasite. Also showed a piece of mottled brown pine bark from stump at Inglenook, Pennsylvania, on which he had found a specimen of *Phaeocyma* sp., of practically the same color, an example of protective mimicry. While the army worm was so abundant last year, now its parasite, *Enicospilus purgatus* Say, is very numerous; they fly in clouds from the grass. Mr. Haimbach exhibited his collection of N. A. Crambinae, comprising 15 genera, 84 species and 556 specimens. Adjourned to the annex.—GEO. M. GREENE, *Secretary.*

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